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(19) (CA) **CANADIAN PATENT** (12)

(54) APPARATUS FOR MEASURING LIQUID VOLUMES

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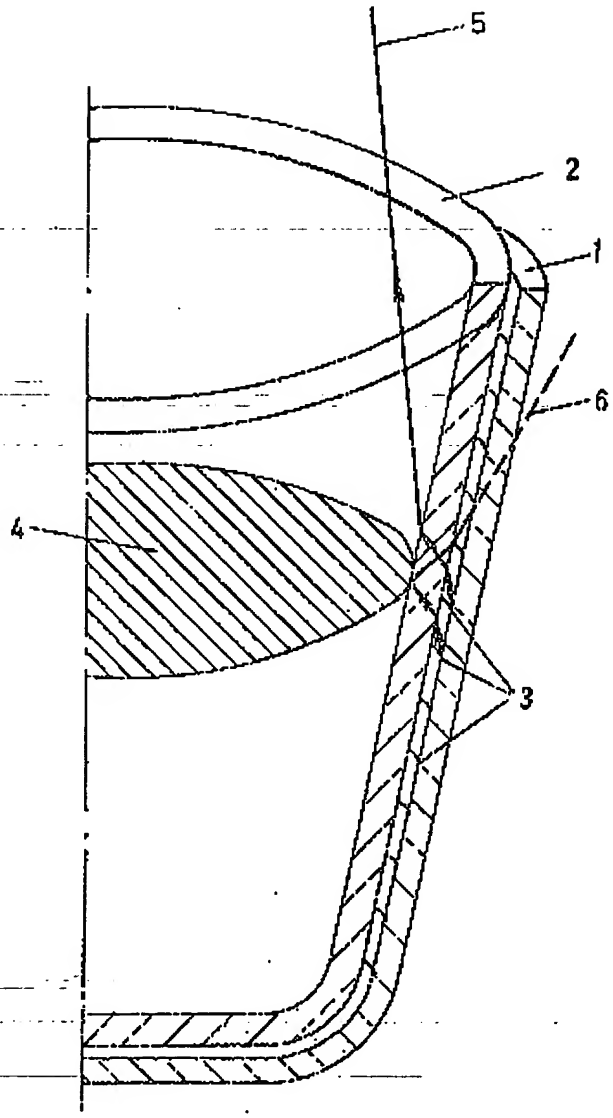

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The present invention r lates to an apparatus for measuring liquid volumes.

According to the invention, there is provided apparatus for measuring liquid volumes, comprising an ungraduated vessel for containing the liquid with a bottom and side walls and an upper opening, at least one part of a side wall being substantially vertical and transparent, and a scale which is disposed outside the transparent side wall part, is provided with graduation lines and is separated by an air gap from the outside surface of said part of the vessel so that rays from the graduation lines of the scale pass through the boundary at the inner wall surface of the vessel when the vessel is empty, the graduation lines thus being visible from the opening of the vessel, while the said rays are totally reflected at the boundary between the inner wall surface of the vessel and the liquid when the vessel is filled with liquid - which of course has a higher refractive index than air - the graduation lines thus no longer being visible from the opening of the vessel.

The invention is based on the principle that the graduated volume scale is disposed outside the liquid-containing vessel in such a way that total internal reflection occurs when a liquid is in the inner vessel, so that the light ray from a graduation line which is

covered by the liquid is subject to total internal reflection on account of refraction in media with different optical densities so that it appears to the eye as though the graduated volume scale disappears from below as the vessel is filled with liquid. Measurement is also facilitated by it being possible for the graduated volume scale to be read off from above while the apparatus is standing on a horizontal support, for example a table and the liquid to be measured is being poured in.

The apparatus according to the invention may be used in all areas of application where it is necessary to measure small or medium-sized liquid volumes, for example for the measuring out of medicine.

The scale may be disposed on an outer vessel which surrounds the liquid containing vessel, both the said vessels in one embodiment being constructed with conical side walls.

The graduation lines may be disposed on the inner surface of the side wall of the outer vessel, or the scale may also be disposed on the outer surface of the side wall of the outer vessel if this is made transparent.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawing, which shows an apparatus according to the present invention in a diagrammatic perspective

view with parts partially cut away.

The apparatus comprises an outer vessel 1 which surrounds an inner vessel 2 with a certain gap between them. The liquid which is to be measured is contained in the inner vessel 2. A graduated scale 3 is disposed on the inner side wall surface of the outer vessel 1. The reference number 4 designates the level of the liquid contained in the inner vessel 2. If the level 4 of the liquid is observed from above in the manner shown in the Figure, at the boundary between the level 4 of the liquid and the inner surface of the side wall of the inner vessel 2 a peripheral light ray 5 from the graduated scale 3 will be refracted in the manner shown in principle in the Figure. A light ray which is below the said peripheral light ray, for example the light ray marked 6 in the Figure, will on the other hand be totally reflected. The line on the graduated scale, lying below the line from which the ray 5 comes, will thus disappear before the eye owing to the total internal reflection.

For these "more central" rays 6 the light will thus travel from one graduation line on the graduated volume scale, disposed outside the inner vessel with a gap therebetween, through media of different optical densities in such a way that the ray is totally reflected. In this way the part of the graduated scale 3 which lies beneath the surface of the liquid is not visible, which facilitates

measurement as it is possible to read off the graduated scale from above. The invention thus avoids the necessity of lifting the vessel up to eye level in order to read off the graduated scale, as in the case of conventional single measuring vessels which are provided with a graduated scale.

In the embodiment of the invention described above by way of example the inner vessel 2 is transparent or has at least one vertical transparent part through which the graduated scale 3 may be observed. In this embodiment the outer vessel 1 is not transparent or is opaque and the graduated scale is disposed on the inner surface of the vessel. Instead of a complete vessel a bar, appropriately positioned relative to the inner vessel and comprising a scale may be used, working in conjunction with the vertical transparent part of the dosing vessel. It is also possible however to make use of a transparent outer vessel 1, in which case the graduated scale 3 may if desired be disposed on the outer surface of the vessel 1.

In the arrangement shown in the Figure the air gap between the outer and the inner vessel has been exaggerated for the sake of clarity.

It will be clear that an outer vessel 1 may be used as a basic unit together with a large number of individual inner vessels 2 which are placed in turn in the outer vessel for the purpose of measuring liquid volumes.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. Apparatus for measuring liquid volumes, comprising an ungraduated vessel for containing the liquid with a bottom and side walls and an upper opening, at least one part of a side wall being substantially vertical and transparent and a scale which is disposed outside the transparent side wall part, is provided with graduation lines and is separated by an air gap from the outside surface of said part of the vessel so that rays from the graduation lines of the scale pass through a boundary at the inner wall surface of the vessel when the vessel is empty, the graduation lines thus being visible from the opening of the vessel, while the said rays are totally reflected at the boundary between the inner wall surface of the vessel and the liquid when the vessel is filled with liquid, which has a higher refractive index than air, the graduation lines thus no longer being visible from the opening of the vessel.

2. Apparatus according to claim 1, characterized in that the scale is disposed on an outer vessel which surrounds the liquid-containing vessel.

3. Apparatus according to claim 2, characterized in that the liquid-containing vessel and the outer vessel are both constructed with conical side walls.

4. Apparatus according to claim 2 or claim 3, characterized in that the graduation lines are disposed on the inner surface of the side wall of the outer vessel.

5. Apparatus according to claim 2 or claim 3, characterized in that the outer vessel is transparent and the graduated scale is disposed on the outer surface of the side wall of the outer vessel.


90°
180°
2 / 2

ABSTRACT

A liquid volume measuring apparatus has two parts. One part is a vessel into which the liquid to be measured is poured. The vessel is transparent or has a transparent part and a scale (the other part) is arranged outside the vessel so that it can be seen through the transparent vessel wall. There is an air gap between the scale and the vessel. While the vessel is empty and the vessel is viewed from above and inside, the scale can be seen through the transparent wall. However when the vessel is filled, those parts of the scale below the liquid level disappear because the light from these parts is totally internally reflected. The volume of liquid in the vessel can thus be observed from above the vessel.